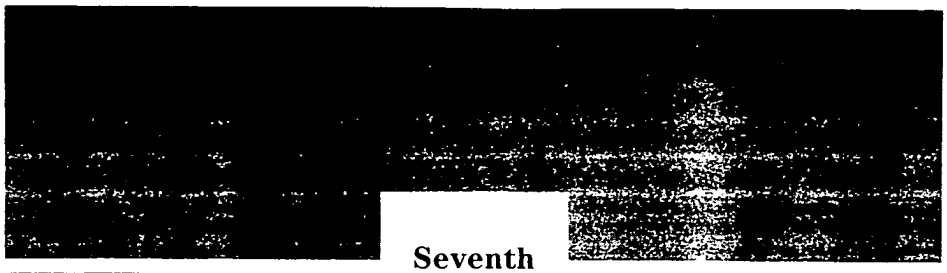
Exhibit D



Seventh Edition

LABORATORY STUDIES OF VERTEBRATE AND INVERTEBRATE EMBRYOS

Guide and Atlas of Descriptive and Experimental Development

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PLATES

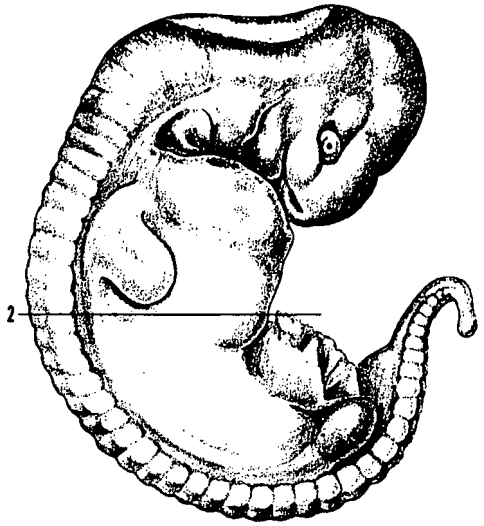
41-58

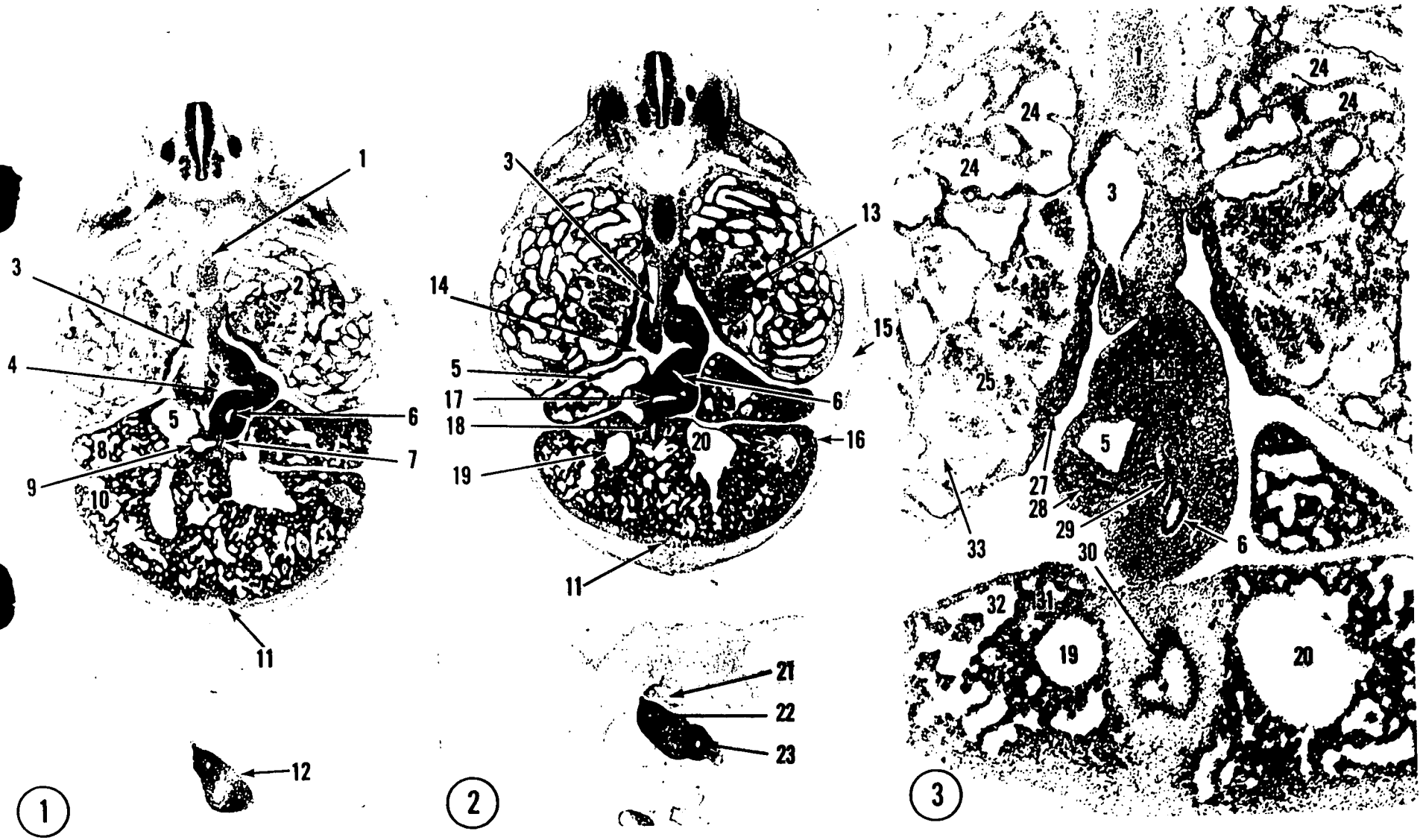
10-MM PIG EMBRYOS

PLATE 50

10-MM PIG EMBRYO SERIAL TRANSVERSE SECTIONS

1. Descending aorta
2. Mesonephric kidney
3. Inferior vena cava
4. Omental bursa
5. Portal vein
6. Duodenum
7. Hepatoduodenal ligament
8. Right dorsal lobe of liver
9. Hepatic duct
10. Right ventral lobe of liver
11. Falciform ligament
12. Temporary umbilical hernia
13. Gonad rudiment
14. Epiploic foramen
15. Parietal peritoneum
16. Visceral peritoneum
17. Common bile duct
18. Cystic duct
19. Right umbilical vein
20. Left umbilical vein
21. Common vitelline vein
22. Cranial limb of the intestinal loop
23. Caudal limb of the intestinal loop
24. Mesonephric tubules
25. Glomeruli
26. Dorsal pancreatic rudiment
27. Germinal epithelium
28. Ventral pancreatic duct
29. Dorsal pancreatic duct
30. Gallbladder
31. Hepatic cords
32. Hepatic sinusoids
33. Glomerular capsule

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second branchial arches to either side of the first branchial grooves. These elevations will subsequently fuse on each side to form the **pinna (auricle)** of the **external ear.**

3. Urogenital system

Aids: Fig. T; A, Figs. 599, 601, 603; M, Figs. 234 and 235; PA, Figs. 59, 60, 64.

Return to the level of the cloacal membrane (Plate 52, Fig. 2) and trace sections posteriorly until the cloaca is reached. Note that the ventral (upper) portion of the cloaca broadens transversely. This broadened portion is the **urogenital sinus.** The urogenital sinus is continuous with the **mesonephric ducts** in more posterior sections (Fig. T; Plate 53, Fig. 1). Continue tracing sections posteriorly, following the mesonephric ducts. Note that they lie lateral to the colon (Plate 53, Fig. 2). They are quickly cut frontally, as they join another portion of the mesonephric ducts located in the ventral part of the large **mesonephric kidneys** (Plate 53, Fig. 3). The mesonephric ducts disappear a few sections more posteriorly.

Return to the level where the mesonephric ducts are cut frontally (Plate 53, Fig. 3) and trace that part of each mesonephric duct within the mesonephric kidney *anteriorly.* Note that numerous **mesonephric tubules** are continuous with it. Continue to trace sections *anteriorly* until the mesonephric ducts can no longer be identified. The mesonephric duct on each side will form the **epididymis, vas deferens,** and **ejaculatory duct** of the adult male reproductive system; it will also give rise to an evagination that forms the **seminal vesicle.** The mesonephric ducts mainly degenerate in the female.

Note the tremendous size of the mesonephric kidneys relative to that of other structures of the pig embryo (see A, Fig. 599; M, Fig. 234; PA, Fig. 59). This large size probably counteracts the rather inefficient **placenta** of pig embryos (**diffuse, epitheliochorialis type** with a **placental membrane [barrier]** composed of many layers). The placenta apparently does not remove nitrogenous wastes from the bloodstream of pig embryos very readily; pig embryos therefore possess massive mesonephric kidneys to take care of this function. Examine a section cut through about the middle of the mesonephric kidneys (Plate 52). Note that this type of kidney consists mostly of **mesonephric tubules.** These tubules mainly degenerate in females. In males some mesonephric tubules persist as the **efferent ductules (vasa efferentia)** of the adult reproductive system; the remaining tubules degenerate. At the medial side of each mesonephric kidney, note several large spaces bounded by a very flat epithelium and filled with cells. These expanded spaces are the **glomerular (Bowman's) capsules** of the mesonephric tubules (Plate 52, Fig. 1). The cells within the glomerular capsules are capillaries, constituting the **glomeruli,** and contained blood cells (Plate 52, Fig. 2). Glomerular capsules and glomeruli of mesonephric kidneys later degenerate in both males and females.

The **gonad rudiments** are just forming at this stage as a thickening on the medial side of each mesonephric kidney (Plate 50, Fig. 2; Plate 51, Fig. 3; Plate 52, Fig. 2). Each gonad rudiment consists of a localized thickening of visceral peritoneum (that is, a localized thickening of the splanchnic mesoderm that covers the organs of the peritoneal cavity), called the **germinal epithelium,** and a subjacent region of condensed mesenchyme (Plate 50, Fig. 3). The gonad rudiments contain **primordial germ cells** (not readily identifiable), which in mammals originate from the **endoderm** of the caudal portion of the **yolk sac.** These cells then undergo an extensive migration through the splanchnic mesoderm of the yolk sac and the dorsal gut mesentery to reach the gonad rudiments.

Return to the level where the mesonephric ducts connect to the urogenital sinus (Plate 53, Fig. 1) and trace sections posteriorly. Note that a small duct emerges from the dorsal (lower) side of each mesonephric duct shortly after the urogenital sinus fades out (Plate 53, Fig. 3). These ducts are the ureters. Continue tracing sections posteriorly, noting that the **ureters** separate from the mesonephric ducts and that each eventually expands as the **renal pelvis** (Plate 54, Fig. 1). The distinct epithelial walls of these structures (that is, the layer next to the lumen) later bud repeatedly, forming the **major** and **minor calyces** and **collecting tubules** of the **metanephric kidneys.** The very dark mass of cells just outside each renal pelvis consists of condensed **nephrogenic tissue** (Plate 54, Fig. 1), which forms the **secretory tubules** of the **metanephric kidneys.** Thus, development of the metanephric kidneys involves both epithelial and mesenchymal com-